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Session 6 - Environmental Systems: Management and Optimisation

**Session 7 - New Methods and Technologies for Medicine and
Biology**

Session 8 - Embedded System Design and Application

Session 9 - Image Processing, Image Analysis and Computer Vision

Session 10 - Mobile Communications


Session 11 - Education in Computer Science and Automation

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Preface

Dear Participants,

Confronted with the ever-increasing complexity of technical processes and the growing demands on their efficiency, security and flexibility, the scientific world needs to establish new methods of engineering design and new methods of systems operation. The factors likely to affect the design of the smart systems of the future will doubtless include the following:

- As computational costs decrease, it will be possible to apply more complex algorithms, even in real time. These algorithms will take into account system nonlinearities or provide online optimisation of the system's performance.
- New fields of application will be addressed. Interest is now being expressed, beyond that in "classical" technical systems and processes, in environmental systems or medical and bioengineering applications.
- The boundaries between software and hardware design are being eroded. New design methods will include co-design of software and hardware and even of sensor and actuator components.
- Automation will not only replace human operators but will assist, support and supervise humans so that their work is safe and even more effective.
- Networked systems or swarms will be crucial, requiring improvement of the communication within them and study of how their behaviour can be made globally consistent.
- The issues of security and safety, not only during the operation of systems but also in the course of their design, will continue to increase in importance.

The title "Computer Science meets Automation", borne by the 52nd International Scientific Colloquium (IWK) at the Technische Universität Ilmenau, Germany, expresses the desire of scientists and engineers to rise to these challenges, cooperating closely on innovative methods in the two disciplines of computer science and automation.

The IWK has a long tradition going back as far as 1953. In the years before 1989, a major function of the colloquium was to bring together scientists from both sides of the Iron Curtain. Naturally, bonds were also deepened between the countries from the East. Today, the objective of the colloquium is still to bring researchers together. They come from the eastern and western member states of the European Union, and, indeed, from all over the world. All who wish to share their ideas on the points where "Computer Science meets Automation" are addressed by this colloquium at the Technische Universität Ilmenau.

All the University's Faculties have joined forces to ensure that nothing is left out. Control engineering, information science, cybernetics, communication technology and systems engineering – for all of these and their applications (ranging from biological systems to heavy engineering), the issues are being covered.

Together with all the organizers I should like to thank you for your contributions to the conference, ensuring, as they do, a most interesting colloquium programme of an interdisciplinary nature.

I am looking forward to an inspiring colloquium. It promises to be a fine platform for you to present your research, to address new concepts and to meet colleagues in Ilmenau.



Professor Peter Scharff
Rector, TU Ilmenau



Professor Christoph Ament
Head of Organisation

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New Film Temperature And Moisture Microsensors For Environmental Control Systems

Environmental Systems: Management and Optimisation

Progress in electronic technologies and such advantages as small dimensions and weight, high thermosensitivity have resulted in rapid development of a new type of sensors - film temperature and moisture sensors. Such types of microsensors can be easily embedded in diverse computerized control systems, used, for example, for management of environmental of various agriculture storage installations, which generally must function with strictly predefined temperature and humidity ranges.

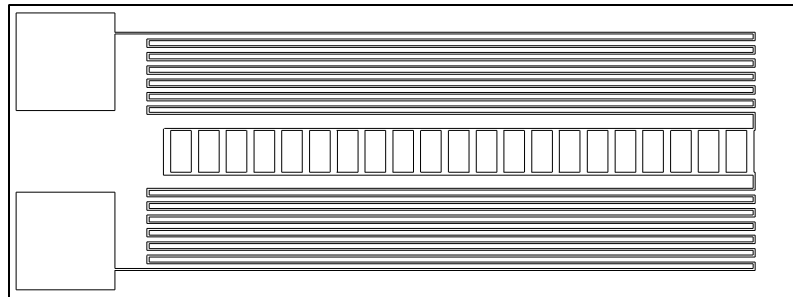
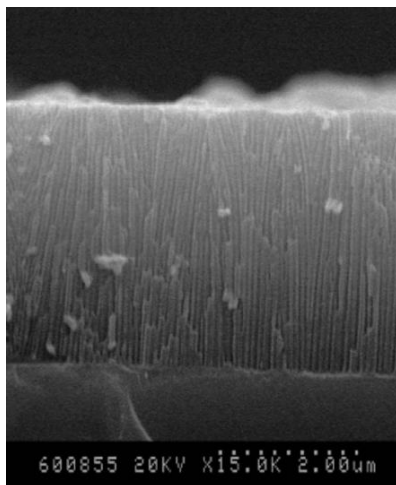
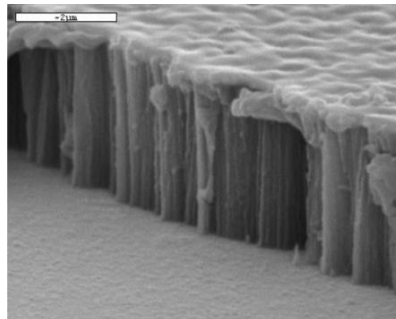


Fig. 1. Topology of copper film sensor structure

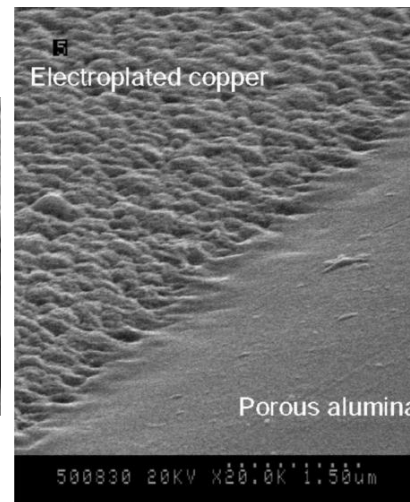
Our sensors represent microelectronics devices with area of 2x5 mm with two leads each (Fig. 1). They are developed on the basis of the hybrid nanoporous alumina technology (Fig. 2).



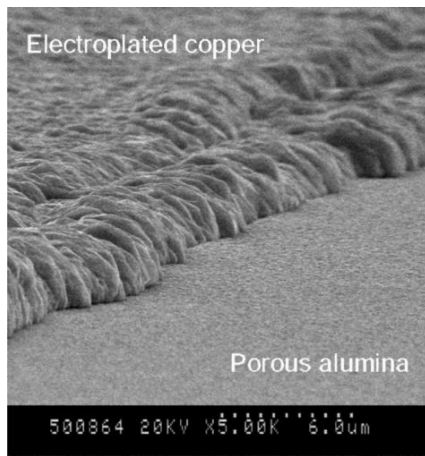
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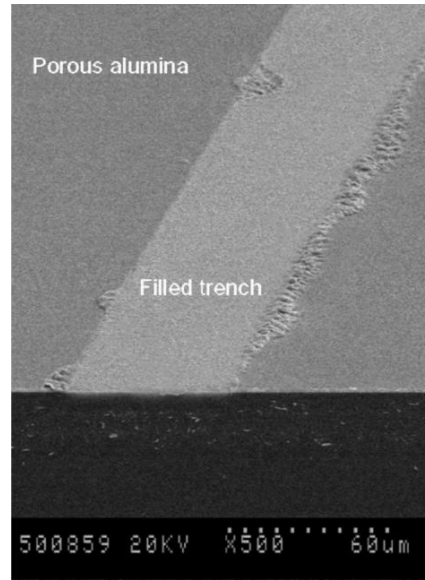
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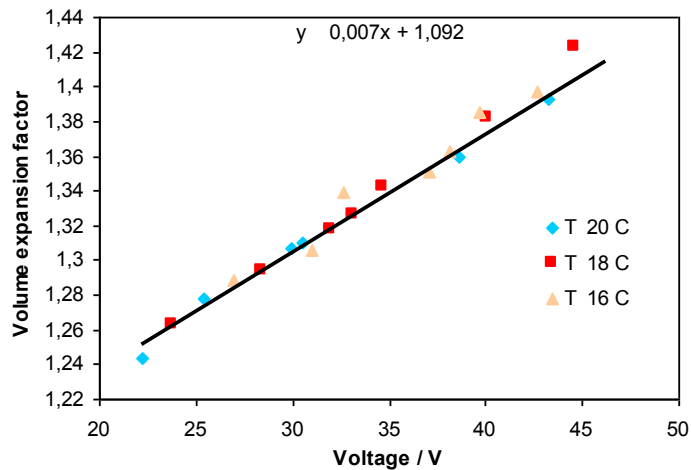
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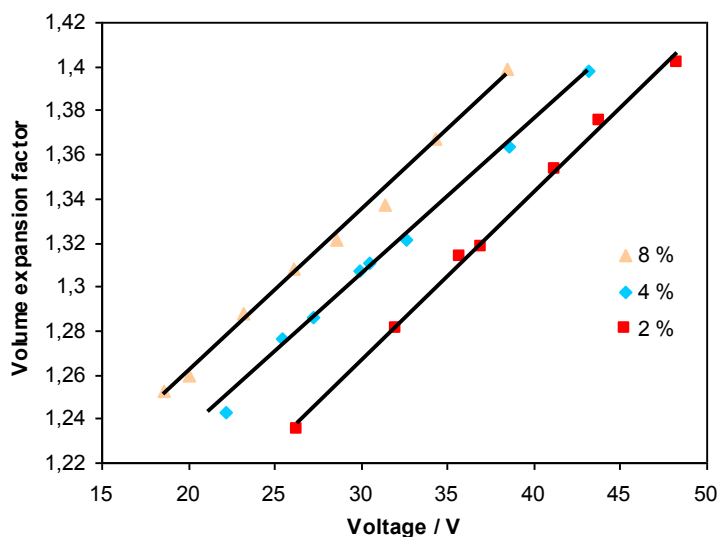
e

Fig 2. Hybrid nanoporous alumina technology: **a** - SEM image of nanoporous alumina; **b** - SEM image of electrolessly deposited Cu layer in the bottom of the trench; **c** - SEM image of planar ECP copper – nanoporous alumina interface; **d** - SEM image of ECP copper - nanoporous alumina interface; **e** - SEM image of Cu-filled trench (sensor structure).

Temperature sensors have electric resistance of 50 Ohm and protecting dielectric based on nanoporous alumina made by electrochemical anodizing in water solution of oxalic acid (Figs. 3 and 4).



(a)



(b)

Fig. 3. Volume expansion factor (k) vs anodizing voltage in the steady-state growth region of the porous alumina film as a function of temperature (a) and electrolyte concentration (b): **(a)** 4 % solution of oxalic acid at the temperature of 16, 18 and 20 °C; and **(b)** 2, 4 and 8 % solution of oxalic acid at 20 °C.

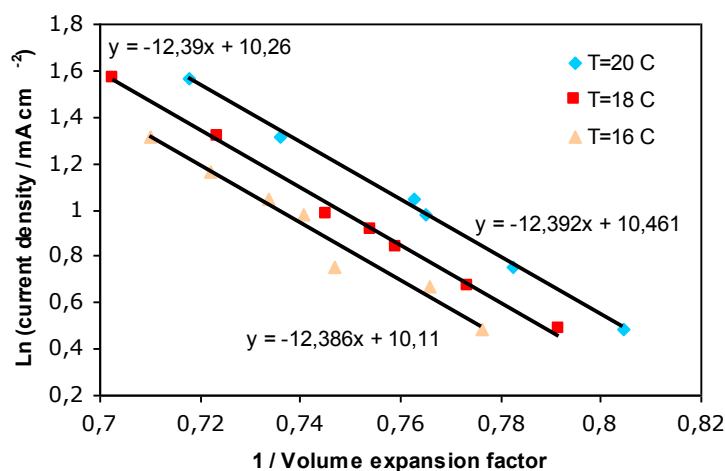


Fig. 4. Dependence of anodic current density logarithm on the inverse volume expansion factor of the porous alumina film as a function of temperature. 4 % solution of oxalic acid at the temperature of 16, 18 and 20 °C.

Their electric characteristics were studied in the temperature range of -60 to 160°C. The principle of operation of developed moisture sensors lies in periodical monitoring of capacitance of thin (2,5 micrometers) film of anodized alumina. At the end of each measurement cycle that porous film can be dried by means of embedded heater layer. Thus the critical low lag effect is achieved.

Main distinguishing feature of our devices in comparison with similar film sensors is the usage of nanoporous alumina as a material for protecting and insulating coating. The main problem at manufacture of such film temperature sensors is a mutual co-ordination between elastic properties of thermosensitive material and protecting insulating coating. An important feature of nanoporous alumina is a low elastic modulus of about 90-140 GPa comparing with the value of 340-380 GPa for non-porous alumina [1,2]. This feature allows to reduce mechanical stresses arising in film structures, for example at cycle heating and cooling. Thus, the long-term stability of electric characteristics of such film sensors improves. Another important technological feature – usage of electrochemical deposited copper as a thermosensitive material in temperature sensors and as a material of interconnections in moisture sensors [3]. Electrochemical deposition of Cu provided high purity of films and thus - high reproducibility of measurements.

References:

- [1] Sokol, I. Vrublevsky, V. Parkoun, K. Moskvichev, Anal. Bio. Chem. 375 (2003) 968.
- [2] Z. Xia, L. Riester, B.W. Shedd, W.A. Curtin, J. Liang, A. Yin, J.M. Xu, Rev. Adv. Mater. Sci. 6 (2004) 131.
- [3] M. Traving, I. Zienert, E. Zschesh, G. Schindler, W. Steinhögl, M. Engelhardt, Appl. Surf. Sci. 252 (2005) 11.

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